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ABSTRACT

The failure to successfully complete gateway calculus courses often prevents ethnic minority students from pursuing science and engineering majors. Research suggests that this failure to succeed is caused more by social factors than by attributes related to ability. This article presents the findings of an evaluation study done of the Wisconsin Emerging Scholars Program, a non-remedial, multicultural workshop approach to learning calculus. Through its emphasis on community and collaboration, it is more culturally relevant and designed to foster substantial participation from underrepresented ethnic minority groups. The Wisconsin Emerging Scholars Program also helps to alleviate the problems of isolation and lack of support that can occur at universities. When the program is implemented optimally, a community of confident calculus learners who outperform traditional students academically emerged. Contains 24 references. (DDR)

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A Community Approach to Learning Calculus: Fostering Success for Underrepresented Ethnic Minorities in an Emerging Scholars Program

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Abstract

Failure to successfully complete gateway calculus courses often prevents ethnic minority students from pursuing science and engineering majors. Research suggests that this failure to succeed is caused more by social factors than attributes related to ability. This article presents the findings of an evaluation study of the Wisconsin Emerging Scholars (WES) Program, a non-remedial, multicultural workshop approach to learning calculus. Through its emphasis on community and collaboration, WES is a more culturally relevant approach to learning calculus and is designed to foster substantial participation of underrepresented ethnic minority students. The WES approach also helps to alleviate the problem of isolation and lack of support that ethnic minorities can face in a large, predominantly white university. Optimal program implementation creates a community of confident calculus learners who academically outperform traditional calculus students and who are better prepared to succeed in future science and engineering courses.

Introduction

There has been much discussion of the problem of retaining ethnic minorities in the fields of science, math and engineering (SME). National data shows that ethnic minority students are disproportionately underrepresented in these disciplines at every juncture in the "pipeline": as undergraduate majors, in graduate programs, and as faculty members (Massey, 1992; National Science Foundation, 1996, in press). Data suggests that a significant loss of minority students from SME fields occurs between the freshman and sophomore years (National Academy of Sciences, 1987); this attrition corresponds to the time period when students encounter difficult gateway classes like calculus (Gainen, 1995). For this reason, calculus persists as a serious barrier preventing ethnic minority students from entering science, math, and engineering fields (National Science Foundation, 1989, Seymour & Hewitt, 1994).

In the mid 1970s Treisman (1985, 1990) investigated why African American students were failing calculus at much higher rates than Chinese American students at UC-Berkeley. His research showed that the Chinese American students integrated their social and academic lives by completing homework assignments and studying for exams together. By contrast, he found that most African American students studied in isolation and had little social interaction with their calculus peers outside of class (Fullilove & Treisman, 1990; Treisman, 1985, 1990).

In response to these research findings, Treisman pioneered the Emerging Scholars (ES) Program at the University of California-Berkeley in the early 1980s and further developed it at the University of Texas-Austin with Efraim Armendariz and Jackie McCaffrey. Traditional calculus courses generally consist of a large lecture component supplemented by recitation sections ("discussion sections"). These discussion sections typically involve little, if any, true discussion. Rather, the student interaction primarily consists of discrete exchanges between the instructor and individual students where the instructor addresses student queries or recapitulates portions of the course professor's lecture. By contrast, ES programs are based on a workshop model in which the process of doing math is predominantly student-centered and collaborative.

ES programs have been successfully adapted by universities nationwide (Selvin, 1992). Myers and McCaffrey (1994) discuss how the ES program at University of Texas-Austin improved the academic performance of ethnic students stating:

> ...fewer than one third of African American and Hispanic American students who took calculus in the five years prior to the [Emerging Scholars] program's inception earned grades of A or B. In contrast, approximately 80 percent of the African American and Hispanic American students who have participated in ESP [Emerging Scholars Program] since its inception in 1988 have earned grades of A or B in calculus.

Bonsangue (1994, 1995) reports similar performance results in the California State Polytechnic University-Pomona ES program. In this longitudinal study he found that within three years of

matriculation, 52% of the minority students who were enrolled in traditional discussion sections had either withdrawn from the institution or switched to a non-mathematics-based major. This contrasted significantly with the ES students of whom only 15% had withdrawn or switched majors. In addition, ES students had much lower course repetition rates. Nearly half (46%) of the traditional calculus minority students required five or more quarters to complete a three-quarter calculus sequence as compared to fewer than one-fifth (17%) of the workshop students. In addition, the ES program had an impact on student performance in subsequent mathematics courses.

ES programs fall within the broader context of calculus reform. A number of programs have been developed to address a national concern about the quality of calculus education which has been viewed as "out of date in content, unimaginative, poorly organized for students with different interests, and not reflecting recent advances in the understanding of teaching and learning" (NSB, 1986). Calculus reform programs such as the Calculus Consortium based at Harvard or *Calculus Using Mathmatica* based at the University of Iowa, typically involve the use of technology such as computers and calculators, the incorporation of practical, real life applications of the material, and innovative teaching (Armstrong, Garner, & Wynn, 1994). These programs, unlike ES programs, involve a fundamental restructuring of the calculus curriculum and are intended to replace existing calculus course structures. By contrast, ES programs are designed so as to be adaptable to the existing calculus course structure.

Another program that is associated with calculus reform is the Supplemental Instruction (SI) program created at the University of Missouri-Kansas City (Burmeister et al., 1994). SI calculus programs, which consist of non-remedial collaborative-based study sessions offered on a voluntary, non-credit basis, are similar to ES programs in that they do not involve curricular restructuring. Unlike ES programs, however, SI does not specifically target ethnic minority students but rather is open to any student (Arendale, 1994). Perhaps the key factor in differentiating all of these calculus reform programs from ES programs is that they are designed to help all students regardless of ethnic background, while ES programs are specifically targeted for ethnic minorities.

Multiple programs, other than those discussed above, have been developed to specifically address the calculus performance of ethnic minority students. These programs are often remedial in nature in that they focus on strengthening students' mathematical weaknesses. However, according to Fullilove and Treisman (1990), "undergraduate persistence and graduation rates reported for African Americans and other underrepresented minority students suggest that, on a nationwide level at least, these programs have not been particularly successful."

The ES program is unique among calculus reform programs in its combination of the following features. First, although ES programs are established to assist underrepresented minority students, they are typically comprised of approximately 25% majority students in order to create a heterogeneous community of calculus learners who are committed to pursuing mathematics-based careers. Second, ES programs are not remedial in that they emphasize students' strengths rather

than weaknesses, and, in fact, some universities designate them as an honors program. To be admitted to the program, all students must demonstrate a certain level of proficiency based on incoming test scores and grades: the program is not designed for students with insufficient mathematical preparation. Third, ES programs are designed to fit into the existing calculus course structure. Fourth, the pedagogical method is innovative in that the workshops are student-centered and collaborative. Finally, the program attempts to create a learning community in which the social and academic spheres are intertwined.

How ES Programs Address the Needs of Minority Students

ES programs provide an advantageous learning environment for ethnic minority students in a number of ways. Perhaps the most essential component of an ES program for ethnic minorities is its establishment of a community with substantial minority participation. Researchers have discussed the importance of community formation and collaborative learning in the classroom because these approaches are culturally relevant for many underrepresented ethnic minority students (Delpit, 1995; Fordham, 1991; Ladson-Billings, 1994). Fordham (1991) argues that the dominant American school culture rewards "behavior and an interactional style which is essentially an inversion of [the African American] indigenous cultural pattern." In particular, she discusses the dominant cultural notion that academic success is founded on independent work with an emphasis on outperforming others. This is potentially conflictual for many ethnic minority students because of their collective sense of ethnic identity which is based on a different cultural conception of self and relationship to community. ES programs, through their emphasis on community and collaboration, create a group-centered ethos that may be more culturally appropriate for underrepresented ethnic minority students and thus may contribute to their success (Fordham, 1991).

A further reason why establishing an ethnically diverse community is important in a university setting, particularly in math- and science-based disciplines, is because of the critical issue of maintaining a sense of ethnic identity. Fordham and Ogbu (1986) argue that African Americans have established a sense of collective identity that is in part rooted in kinship-like relationships. This collective social identity structures and defines relationships in the African American community (Fordham, 1991). Students may be fearful of the potentially alienating effects of their academic success vis-a-vis their relationships with peers, family, and ethnic community. Fordham and Ogbu suggest that "subordinate minorities regard certain forms of behavior and certain activities...as *not appropriate* for them because those behaviors...are characteristic of White Americans (1986, p. 183). Therefore, for some ethnic minorities there exists an ideology in which academic success is equated with "acting white," thereby posing a threat to the students' sense of ethnic identity. As a result many ethnic minority students may feel forced to make a choice between academic success and their cultural identity. An African American student at the University of Wisconsin-Madison (hereafter, UW-Madison) articulated this dilemma when he stated:

> When it comes to minorities, one of the reasons there are not a lot of minorities who are in

> technical fields, higher mathematics, higher sciences, is because people in their own culture downgrade them if they do it...You try to go on to calculus and they say, "Oh, well, you are trying to be white."

This situation can be particularly difficult for first-generation college students who may not have the support or understanding of their families (Rendon, 1994). Some families, fearing that their child or relative may fail or that they will become alienated from the family and from their ethnic minority community, may benignly undermine the student's aspirations by not encouraging them to persevere when they encounter difficulties. This situation is exacerbated in the fields of math, science, and engineering, which are stereotypically considered non-traditional fields for underrepresented ethnic minorities, while also having a reputation for being extremely competitive and difficult. For example, an African American student at the UW-Madison discussed this issue when he commented on his family's reaction to his decision to pursue a major in engineering.

> There are people out there that say, 'You shouldn't be doing it' and there are people who say, 'We love you, but don't do it 'cause you are not going to make it'...They really care about you, but they see how difficult it is and they don't want to see your heart broken when you don't make it.

The dominant educational culture and its ubiquitous stereotypes of ethnic minority students as unlikely to succeed in math- and science-based disciplines can become internalized in the minds of aspiring scholars, causing them to doubt their abilities and experience a lack of self-confidence when they enter college. The fundamental features of an ES program counteract this erosion of confidence.

Historically many ethnic minority students have not persisted in the calculus course sequence because they have struggled with both ethnic identity issues and isolation, in addition to the academic rigors of calculus courses that all students face. The study reported here examines the factors that led to student success in the Wisconsin Emerging Scholars (WES) Program at the UW-Madison. We looked at two key quantitative indicators of program success, academic performance and retention in the calculus sequence, and used a qualitative analysis of student experience in the program to explore the relationship between program practices and outcomes in the WES Program. Specifically, we considered the effect of community formation, cultural relevance, and innovative pedagogy on the success of the minority students in the WES Program.

The research presented in this paper was conducted by The Learning through Evaluation, Adaptation and Dissemination (LEAD) Center, a third party evaluation unit at the UW-Madison, during the WES Program's first two years of implementation. Qualitative data was collected primarily through open-ended interviews and workshop observations. Quantitative data was obtained through student records. Similar data was collected from a control group comprised of students from traditional discussion sections.

Wisconsin Emerging Scholars Program

The UW-Madison implemented an Emerging Scholars Program in 1994 in order to assist ethnic minority students in both attaining higher calculus grades and achieving a more successful longterm academic experience in mathematics and science at this predominantly white research institution. Students in the WES Program attend the same large calculus lecture, do regular homework problems, take the same exams, and are graded in the same fashion as students enrolled in the traditional discussion sections. However, instead of enrolling in a discussion section led by a graduate teaching assistant (TA) that meets twice a week for 50 minutes, WES students enroll in a workshop that meets for two hours three times a week. Students receive an extra two credits for this time commitment. In each workshop session, the TA provides students with worksheets comprised of carefully designed difficult problems that can best be solved when students work collaboratively. Sitting around tables in heterogenous groups of three or four, the WES students solve the problems together, while the TA and an undergraduate student assistant (SA) roam the room asking strategic questions and offering hints when particular groups ask for help or are obviously frustrated. In order to foster a situation in which students turn to their peers rather than instructors for assistance in the problem solving process, the workshop instructors avoid directly answering students' questions.

Workshops are typically comprised of 15 to 18 students, whereas traditional discussion sections enroll up to 25 students. The workshop composition that the WES Program tries to achieve is a heterogenous group of approximately 50% underrepresented ethnic minority students and 50% white students. This ratio of underrepresented minorities to white students is lower than many ES programs because for the last decade, less than 4% of the UW-Madison undergraduates have been underrepresented ethnic minorities (UW-Madison Office of Budget, Planning and Analysis). Recruitment efforts for the WES Program target a number of underrepresented ethnic minority groups including Native Americans, African Americans and Hispanic Americans. What differentiates the WES Program from other ES programs is that in addition to targeting underrepresented minorities, the program also targets women and students from rural backgrounds, both of whom also have high attrition rates in the fields of science, math, and engineering. In order to create a gender-balanced environment that is comfortable for women, the WES Program attempts to enroll an equal number of male and female students, in contrast to traditional discussion sections which enroll proportionately more males. The rural students are recruited because preliminary data suggests that this population faces difficulties in making the transition from small rural school settings to a large urban university.

Through the student-centered, collaborative approach used in the workshops, the WES Program attempts to provide a socially-based academic experience in which a community of calculus learners can develop. In order to expand this community beyond the classroom, WES students are encouraged to study and socialize together outside of class. They are provided a list of students' names and phone numbers, invited to participate in social events planned by the TAs, and have the option of residing on a WES dormitory floor.

Quantitative Results

The two outcome measures investigated in our quantitative analyses were end-of-course grades, represented by a grade point score ranging from 0.00 (F) to 4.00 (A), and percentage of course completers. Students in the WES Program and students in traditional discussion sections (DS) were compared on these measures through an analysis of covariance that used high school percentile rank and math placement scores as the covariates or "control variables." Such an analysis enables us to adjust the outcome measures for pre-existing differences in high school rank and math placement scores, both of which were found to be significantly correlated with the outcome measures.

According to these analyses, WES students consistently outperformed DS students with respect to adjusted mean grades. As can be seen in Figure 1, the WES students' adjusted mean grades were .4 to .7 grade points higher than the DS students' adjusted mean grades for each of the five course semesters studied. This was a statistically significant difference ($p < .05$) for all but one course semester (Math 221 of Fall 1994). Additionally, when grades were ranked and analyzed at the section level, WES sections consistently outperformed the majority of traditional discussion sections. For example, in the Fall 1993 semester, the WES sections ranked 2nd and 13th among the 66 sections of first-semester calculus with respect to mean grades, a nonchance difference favoring WES students, $p = .023$. The following semester, the two WES sections ranked 1st and 2nd out of 45 second-semester calculus sections, another nonchance difference favoring WES students, $p < .001$. These findings illustrate that the WES Program provides a beneficial learning environment for most students, regardless of ethnic background.

Place figure 1 here

With respect to underrepresented ethnic minority students, the WES Program appears to be successful in improving both mean grades and retention rates in these difficult gateway courses. Figure 2 shows that ethnic minority students enrolled in the WES Program have consistently outperformed the ethnic minority students enrolled in traditional discussions in terms of adjusted mean grades since the program's inception. The largest impact was seen in Spring 1994, when the WES ethnic minority adjusted mean grade was 3.32 compared to the DS ethnic minority adjusted mean grade of 2.39, a statistically significant difference, $p < .05$. Analysis of retention rates demonstrates that the WES minorities are more likely than DS minorities to complete the individual courses in the calculus course sequence. As can be seen in Figure 3, the course completion rates of the WES minorities and the DS minorities differed by as much as 36%, and these differences were statistically significant ($p < .05$) for two course semesters: Math 221 of Fall 1993 and Math 222 of Spring 1994.

Place Figures 2 & 3 here

We did not statistically analyze the impact of the WES Program on the minorities from the second cohort (1994-95) because there were only four minority students in this group of 30, an

insufficient number on which to base such an analysis.

Qualitative Results and Discussion

The Benefits of the WES Community

Through the socially-based academic experience provided in WES workshops, students felt that they belonged to a community of learners dedicated to majoring in the math and science disciplines. This belonging went beyond the classroom setting; students said their participation in the WES community gave them a feeling of belonging which mitigated their sense of feeling "anonymous" in the large calculus lecture as well as at this large research university.

They contrasted this to their experiences in other course discussion sections in which there was little opportunity for peer interaction because the predominant focus was on the teaching assistant. They described the atmosphere in these discussion sections as individualistic and often competitive. One traditional discussion section student described her feelings of isolation in this environment:

> It's really quiet. Nobody talks. I don't even know a lot of the people in my class. People don't ask questions very much. So I don't really know that many people in my class, which I wish I did so that I could work together with them.

Students articulated how important a sense of community in the workshops was in helping them overcome their individual difficulties with the calculus material itself. Students indicated that through the collaborative work they established an ethic of mutual support in which they felt comfortable in admitting areas in which they needed assistance. A student described that:

> When you get to know people, there is more opportunity for you to ask some questions and so forth. Because when you are in an atmosphere full of strangers, you feel less lenient to ask questions because you are afraid of looking bad. But the more you get to know people, the more you are going to be able to trust them. Developing trust is one of the things that helped a lot in the last semester.

By creating a heterogeneous community of fellow calculus students that encouraged one another to persevere, the WES Program provided an additional source of support that helped ethnic minority students overcome the stereotypes they may have internalized about their ability to succeed in calculus. As one African American male articulated:

> One thing the WES Program has helped with is even though you may be doing poor on one quiz or one midterm, the social environment will encourage you to go on... Generally [the students] are very comforting with those things. They will try to help you through it.

The community that is developed in the WES Program also helps to alleviate the problem of isolation that an ethnic minority student can face in a large, predominantly white university. As one

African American student explained: "The majority of my classes are white students, and if I wasn't in Emerging Scholars, I would probably walk through every day and not see a minority." Ethnic minority students are particularly underrepresented in math, science, and engineering departments at the UW-Madison. As a result, some WES students questioned their choice of a major or even a career in these fields because of their feelings of ethnic isolation. A Latino student described his dilemma:

> I think about this a lot, I really do. Is engineering for me, because I don't see anyone like me in [my engineering and computer classes.] Any class I go to I don't see anyone like me, except for WES...If you don't see someone you can associate with in classes, you wonder, and that's what I do a lot. I'm just trying to stick it out as long as I can, figure out if it really is me or not...If I knew there was someone else like me, a background like mine...that would be nice, knowing that I'm not just the only one.

In the community that is formed in the WES Program, ethnic minority students actively associated with others like themselves who were committed to meeting the challenge of calculus in preparation for mathematics-based careers. Through this experience they realized that they were not alone in struggling with the rigors of calculus.

The connection with a community of others like themselves served to prevent students from experiencing a dissonance between academic success and maintenance of ethnic identity. The WES Program provided these students with an environment that enabled them to maintain their racial identity while succeeding in calculus. An African American student discussed this issue when he stated that:

> You don't have to be a genius to do it. You just have to work hard and realize that being a professional, doing mathematics, doing the higher science does not mean that you have to give up who you are or what you used to be, or your family or your culture.

Through integrating the social and the academic, the program created a social support for academic pursuits among minority students. However, it is not clear that having a positive experience in the WES Program is sufficient to enable minority students to overcome the larger problem of being underrepresented in other gateway courses and in math, science, and engineering majors.

<u>The emergence of confident and capable mathematical thinkers</u>

Participation in the WES Program provided what Rendon (1994) has termed a "validating experience" for these students. This experience affirmed the WES students' belief in their own capabilities, counteracting the self-doubt that ethnic minority and other non-traditional students may experience when they enter college. Specifically, we found that through the process of solving challenging problems within a student-centered interactive environment, WES students learned that the ability to solve a calculus problem resides within themselves and their group, rather than with an external authority. By actively discovering their own solutions, these students experienced a

sense of ownership of the calculus. Students explained that a mutual dependency developed in these groups through each group member contributing his or her differing skills and knowledge. In the following interview excerpt an African American student describes his perspective of the group work:

> For the most part we walk into our discussion and [the TA] basically hands out worksheets. We get in a group of three of four people, and we just work problems. And we argue with each other...Then if we can't agree the TA will come over and ask, "Well, what do you think about this?" They're really good about not telling you too much about anything. They like to let you figure stuff out and think for yourself. It's been going real well...I think that groups are really important because, say, he's really good at trigonometry and maybe I'm really good at basic algebraic skills or something. And maybe someone else is just really good at remembering stuff. So when you put all those skills together, we work it together, without leaning on a book or leaning on a professor. We get it from each other.

Furthermore, through the process of teaching each other, the students experienced both external affirmation from their peers and internal affirmation that they have mastery of the material. As one student explained:

> I think it definitely comes from explaining [the problem] to other people because then you gain the confidence that you know [the material] and that's a huge part of it...Once you explain it to them and you see that they understand it, then you know that you have an accurate understanding of the material.

Though the learning process in the WES workshops is often interdependent, WES students simultaneously developed the confidence and mastery of the material required to become self-reliant in their individual pursuit of mathematical studies. Through this validating experience students constructed new identities as confident and capable mathematical thinkers. One student expressed her increased confidence and self-reliance in calculus by relating the following incident during which she tackled an especially difficult problem on her own:

> I'm working, and working and working. I'm like, "I'm never going to get this."...I worked for hours and hours. I just didn't give up and finally, I'm just working along thinking this is another dead end and I got the answer. I think that is the happiest and the proudest of myself this entire year I've felt....In the beginning, I remember those worksheets and I'm like, "What! Are they crazy? There's just no way we have the ability to make it through these insanely hard, abstract, absurd problems."...I don't think I would have believed in myself enough to have gotten through it... But last night I'm like, "Maybe I could get this, maybe If I keep going I'll get this." So, that's the difference between beginning and now -- just going through so many hard problems, I know that it's in my ability.

The importance of an ethnically diverse ES student body

Two problems related to class composition emerged in the first two years of the program. The first problem emerged in the second year of the WES Program when poor recruitment of ethnic minorities,

compounded with an increased number of sections, resulted in several WES sections enrolling only one or two ethnic minority students. It was in these white-dominated sections that stereotypes of token representation emerged. One African American student felt that she was recruited to the WES Program primarily because of her race, not her mathematical abilities:

> I don't know if I should make this comparison, but the white students that are in the class, they are in the program because they're top of their class in math, and I'm in the program because I can do math and because I'm a minority! (laughs) I really do think so!

As we have noted, the optimal benefits a students derive from the WES Program are dependent upon the strength of the community established in the classroom. When there are few underrepresented ethnic minority students, they have a tendency to feel ethnically isolated and like outsiders in the predominantly white WES community. As a result, the experience of being an ethnic minority, and thereby different, becomes salient. As an ethnic minority student that was enrolled in one of these WES sections expressed:

> I am the only Hispanic person there and I see it as if everyone is looking at me to see how well I'm going to be doing. How I do certain things, if I'm different from them, or something, because I'm Hispanic. That's the way I see it. Everybody is looking at me

This sense of marginality with respect to the community prevented some students from forming strong social connections in the workshop. Moreover, for many students it precluded an integration of the social and academic aspects of college life that is a hallmark of ES programs.

Given the above considerations, a lack of ethnic diversity in an ES workshop can actually be detrimental to ethnic minority students. In a traditional discussion section, an underrepresented ethnic minority student may feel isolated and different, but will not feel excluded because these sections lack a community to be excluded from; all students in a traditional discussion section work individually with little social interaction. In a predominantly white ES workshop, however, a sense of not belonging is magnified because there is a community to which everyone else appears to belong. Therefore, the experience of being an isolated ethnic minority in a WES section served to confirm, and in fact heightened, these students' fears that they didn't belong in math- and science based fields.

The second problem occurred when the WES section for the final course in the three-course calculus sequence was comprised of approximately 50% African American students and 50% white students. The composition of the workshop changed because a number of students from other underrepresented groups were not required to take third-semester calculus as part of their chosen majors. This contrasted with the previous two semesters, in which this cohort had workshop sections that were composed of minority students from diverse ethnic backgrounds and white students, and in which there was no racial disharmony. In the pluralistic WES sections, the ethos was characterized by a focus on collaboration and community without any regard to race, whereas in the bicultural WES section, issues of race came to the foreground. In the bicultural WES section, the students

segregated themselves when forming their small-groups and developed an adverse racial dynamic that served to accentuate cultural differences. Both white and African American students actively resisted the instructor's efforts to form integrated groups. For example, the instructor tried to create heterogenous groups by the random distribution of playing cards that designated group assignment. The students responded by covertly trading cards with each other in order to maintain their self-selected groups.

Some African American students commented that they perceived a racist atmosphere, implicating both white students and the white instructors. As a result the African American students changed the way in which they interacted with the white students. One African American explained that, rather than working cooperatively, his group felt they had to outperform the white students:

> One view that we all share is that as African Americans, it's difficult to be in college and to be engineers it's even more difficult...So we come into the atmosphere that we have to do 'X' amount better and 'X' more work...so for your little group alone, we have that kind of attitude that may be projected outward. So if you ask someone else, they might have a bad feeling about our group in a sense.

Conversely, the white students discussed feeling uncomfortable with the social behavior of the African American students. Their stereotypical racial perceptions predominated and precluded the formation of working relationships. For example, many white students complained about the loudness of the African American males. One white student discussed how the noise level interfered with her work, saying: "I mean distracting is not the word for it. I mean it's like, go to a subway station and try and learn something there." Another student, who also complained about the loud atmosphere of the classroom, attributed the resulting tension to the cultural differences of the students: "It's a racial thing...The black culture is totally different from the white culture and I don't know how to interpret a black culture. Absolutely zero idea."

In this case, the bicultural dichotomy in this WES section between two groups of individuals that have historically been in a dominant/subordinate relationship impeded the establishment of a sense of community in the classroom and allowed stereotypes to predominate and produce an undercurrent of racism and prejudice. This did not occur in the more ethnically heterogeneous WES sections. Despite the social problems that occurred in this workshop section, it did not appear to have any effect on academic performance. These WES students still outperformed their traditional discussion section peers. It is important to note that although this problem became apparent early in the semester, no active effort was made at cultural mediation. If addressed early, these types of problems can be prevented.

Conclusion

The implementation of ES programs is not uniform across institutions, but requires adaptation to the local context. As such we have discussed the benefits and the barriers that were encountered in the implementation of the WES Program. The WES Program has opened the calculus gateway for an

increased number of underrepresented ethnic minority students at the UW-Madison. For many, it has helped provide a positive freshmen year experience, building a foundation for future success. As this study demonstrated, WES students consistently outperformed their traditional discussion section peers in terms of end-of-course grade and course completion. These positive outcomes were found to be due to the formation of a socially-based academic community, the presence of which was particularly beneficial for the minority students. However, it is important to note that a single program cannot address all of the needs of underrepresented ethnic minority students. While the program may provide students with some strategies to cope in a predominantly white university environment, it may not be sufficient to enable them to surmount the pervasive problems of racism and ethnic isolation that ethnic minority students face on college campuses. A longitudinal study is still needed to establish whether the beneficial effects of the WES Program are maintained over the course of the students' academic careers.

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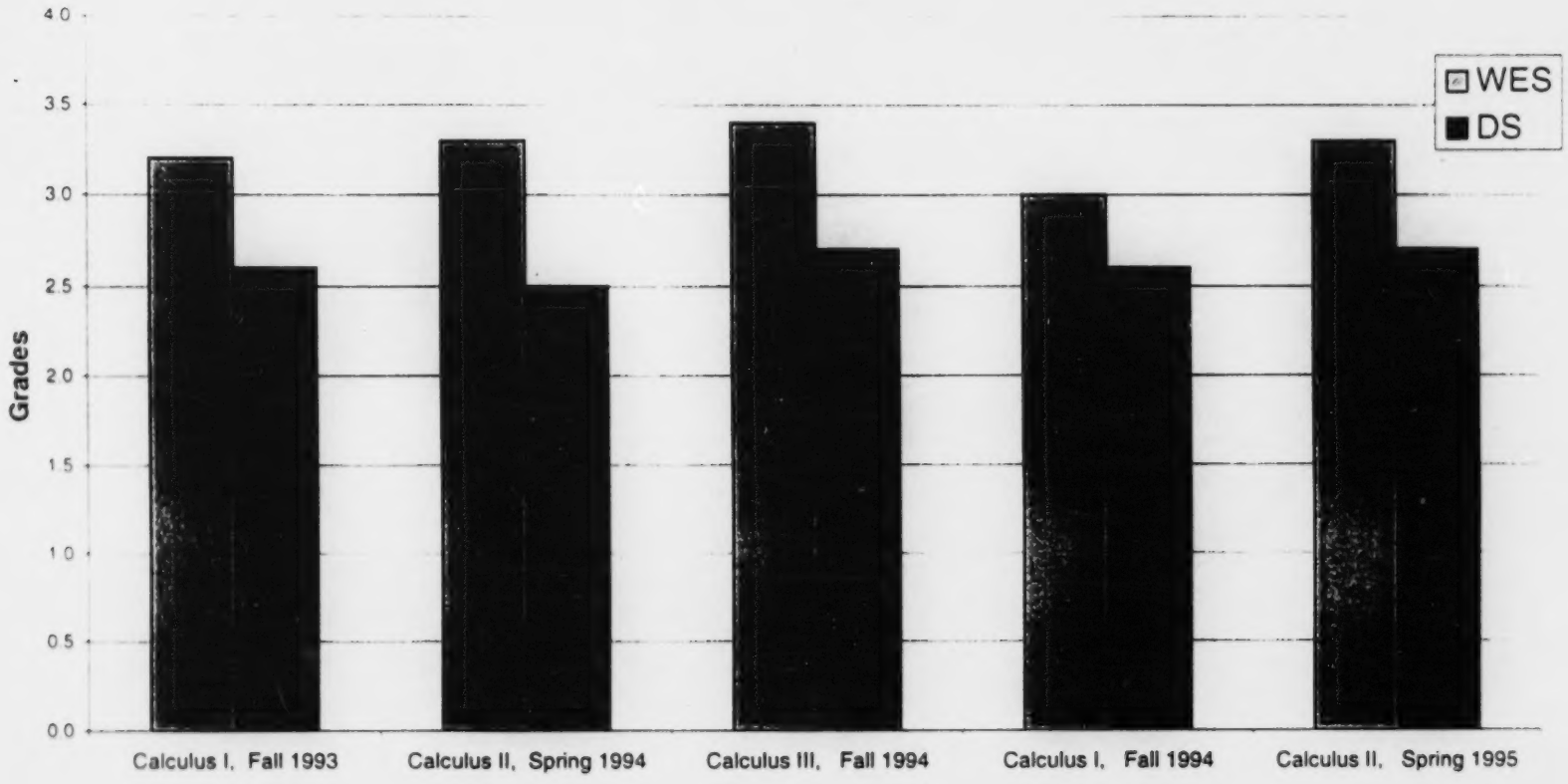
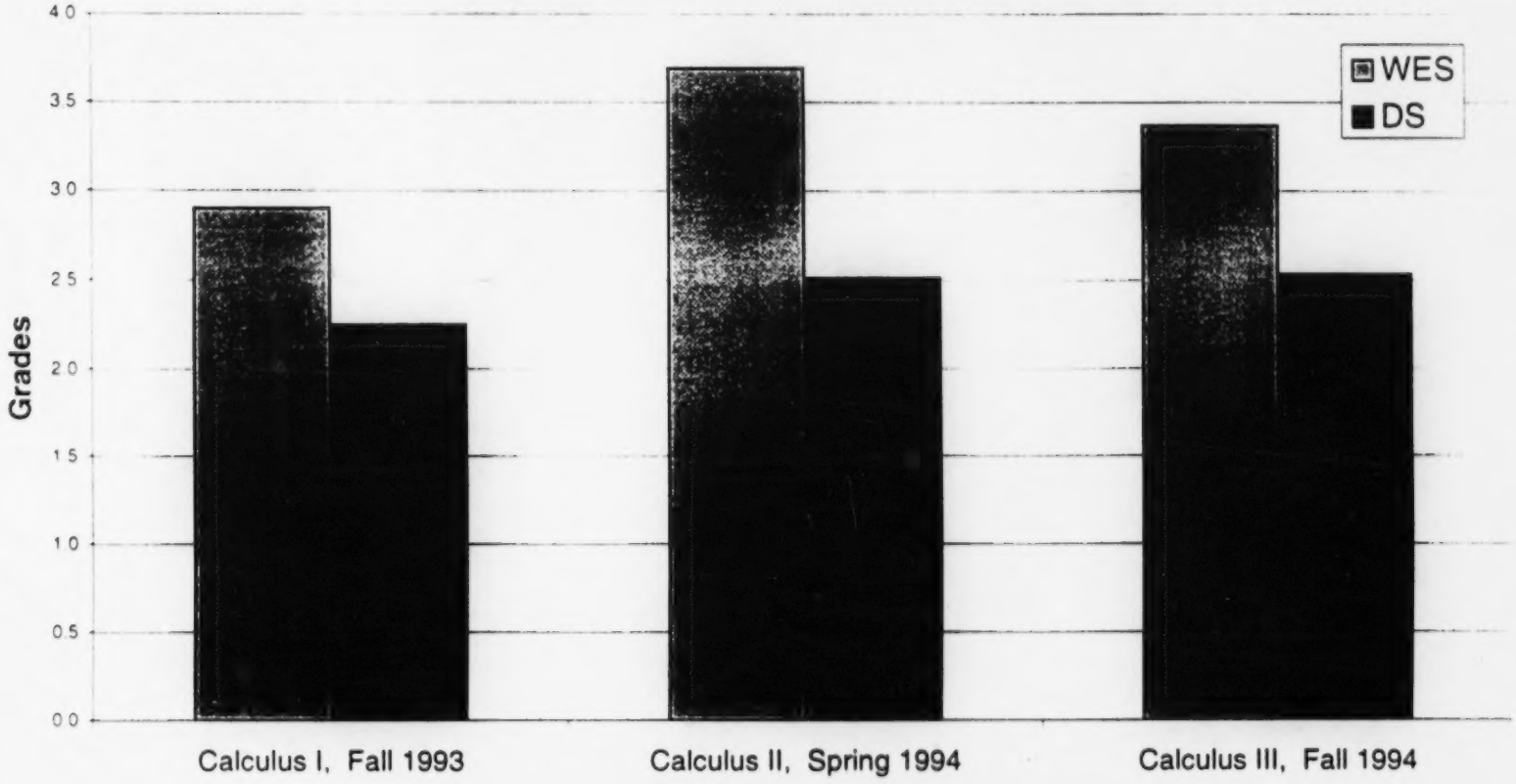
Figure 1
Mean Grades: Calculus I, II & III
WES vs. Traditional Discussion Section (DS)



* Grades were adjusted for incoming high school percentile rank and math placement scores

Figure 2
Ethnic Minority Mean Grades: Calculus I, II & III
WES vs. Traditional Discussion Section (DS)



*Grades were adjusted for incoming high school percentile rank and math placement scores

Figure 3
Percentage of Ethnic Minorities That Completed Calculus Courses
WES vs. Traditional Discussion Section (DS)